



## Early Journal Content on JSTOR, Free to Anyone in the World

This article is one of nearly 500,000 scholarly works digitized and made freely available to everyone in the world by JSTOR.

Known as the Early Journal Content, this set of works include research articles, news, letters, and other writings published in more than 200 of the oldest leading academic journals. The works date from the mid-seventeenth to the early twentieth centuries.

We encourage people to read and share the Early Journal Content openly and to tell others that this resource exists. People may post this content online or redistribute in any way for non-commercial purposes.

Read more about Early Journal Content at <http://about.jstor.org/participate-jstor/individuals/early-journal-content>.

JSTOR is a digital library of academic journals, books, and primary source objects. JSTOR helps people discover, use, and build upon a wide range of content through a powerful research and teaching platform, and preserves this content for future generations. JSTOR is part of ITHAKA, a not-for-profit organization that also includes Ithaka S+R and Portico. For more information about JSTOR, please contact [support@jstor.org](mailto:support@jstor.org).

## SOLUTIONS.

**129** (Average and probabilities) [1902, 148; 1903, 81]. Proposed by J. K. ELLWOOD, Pittsburgh, Pa.

$A$  and  $B$  play with two dice,  $A$  throwing. If he throws 7 or 11, he wins; if he throws 3, or two aces, or two sixes,  $B$  wins. But if he throws 4, 5, 6, 8, 9, or 10, he continues throwing to duplicate this throw, in which event he wins; if in throwing, however, he throws 7,  $B$  wins. What is the expectancy of each? [This is the regulation "crap" game,  $B$  being the banker.]

**155** (Average and probabilities) [1905, 76]. Proposed by E. B. WILSON, Yale University.

The game of craps is played with two dice. If the player throws 7 or 11 on the first throw he wins. If he throws 12, 2, or 3 he loses. If the player throws any other number, that is to say, 4, 5, 6, 8, 9, 10, he is obliged to continue throwing until he throws that number again or until he throws 7. If he succeeds in throwing his first throw before he does 7, he wins—otherwise he loses. Required the odds against him. (Note that he can continue throwing indefinitely without getting either his original throw or the 7).

NOTE BY R. C. ARCHIBALD, Brown University.

The answers to these problems may be found in the article by Mr. Bancroft H. Brown ("Probabilities in the game of 'shooting craps'") in this MONTHLY, 1919, 351-352; see also 1920, 166-167.

**2752** [1919, 72]. Proposed by the late R. E. MOORE.

Test for convergence, the series  $\sum_{n=1}^{\infty} a_n$ , in which

$$a_n = \left[ \frac{1 \cdot 3 \cdot 5 \cdots (2n-1)}{2 \cdot 4 \cdot 6 \cdots 2n} \right]^2.$$

## I. SOLUTION BY P. J. DA CUNHA, University of Lisbon.

On sait que lorsque le rapport  $a_n/a_{n+1}$  est développable suivant les puissances entières de  $1/n$ , il est très facile de décider, dans tous les cas, s'il y a ou non convergence. En effet, si l'on pose, en s'arrêtant aux termes du second ordre,

$$\frac{a_n}{a_{n+1}} = \alpha + \frac{\beta}{n} + \frac{\theta_n}{n^2},$$

$\theta_n$  restant fini pour  $n = \infty$ , il y a:

Divergence si  $\alpha < 1$  ou  $\alpha = 1$  et  $\beta \leq 1$ ;

Convergence si  $\alpha > 1$  ou  $\alpha = 1$  et  $\beta > 1$

(Jordan, *Cours d'Analyse*, troisième édition, tome 1, page 313.)

Cela posé, en appliquant la règle à la série donnée, nous avons

$$\frac{a_n}{a_{n+1}} = \left( \frac{2n+2}{2n+1} \right)^2 = \frac{4n^2 + 8n + 4}{4n^2 + 4n + 1} = \frac{1 + \frac{2}{n} + \frac{1}{n^2}}{1 + \frac{1}{n} + \frac{1}{4n^2}}$$

ou, finalement

$$\frac{a_n}{a_{n+1}} = 1 + \frac{1}{n} + \frac{\theta_n}{n^2}.$$

Comme nous trouvons  $\alpha = 1$ ,  $\beta = 1$ , la série considérée est divergente.

## II. SOLUTION BY OTTO DUNKEL, Washington University.

A proof of the same nature as that of Professor Cunha but requiring only elementary facts is as follows.

Omit the first factor  $(\frac{1}{2})^2$  of each term and consider the series whose general term is

$$b_n = 4a_n = \left(\frac{3}{4}\right)^2 \left(\frac{5}{6}\right)^2 \cdots \left(\frac{2n-3}{2n-2}\right)^2 \left(\frac{2n-1}{2n}\right)^2.$$

Since

$$\left(\frac{2n-1}{2n}\right)^2 = \left(1 - \frac{1}{2n}\right)^2 = 1 - \frac{1}{n} + \frac{1}{4n^2} > \frac{n-1}{n},$$